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AUTHOR	Schaidle, Dale
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ABSTRACT

This report describes a program for infusing technology into the learning process in order to enhance student learning. The targeted population consisted of high school teachers and students in a middle class community in Illinois. The problems related to technology and learning were documented through data that indicated a need for technology that is correctly infused directly into the learning process. Analysis of probable cause data revealed that the use of technology in the learning process without proper orientation of learning principles led to technological oversimplification. Faculty reported student inability to use technology proficiently in the learning process. Based on document analysis and classroom observations, the information presented through technology staff development, teacher interviews, and specific classroom interventions made a positive impact in the correct use of technology. Appendices include the teacher survey, interview questions, Technology for Learning Document Analysis and Classroom Observations sheets, and program sign-up forms. (Contains 18 references.) (AEF)

ENHANCING STUDENT LEARNING THROUGH EFFECTIVE TECHNOLOGY STAFF DEVELOPMENT

Dale Schaidle

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SIGNATURE PAGE

This project was approved by

Priscilla Hastings Ed.D.

Advisor

Jeff Erickson

Advisor

Beverly Gulley, Ph.D.

Dean, School of Education

Abstract

This report described a program for infusing technology into the learning process in order to enhance student learning. The targeted population consisted of high school teachers and ultimately high school students in a middle class community, located in central Illinois. The problems related to technology and learning were documented through data that indicated a need for technology that is correctly infused directly into the learning process.

Analysis of probable cause data revealed that the use of technology in the learning process without proper orientation of learning principles led to technological oversimplification. Faculty reported student inability to use technology proficiently in the learning process.

A review of solution strategies suggested by knowledgeable others, combined with an analysis of the problem setting, resulted in the selection of four major categories of intervention that:

- Provided technology staff development that was ongoing, flexible, offered hands-on learning, opportunities to experiment, provided practical classroom applications, linked technology to the curriculum, illustrated constructivist ideas and utilized higher levels of student thinking. Provided technology staff development that addressed three different levels of technological instruction, and introduced the idea of technology coaches.

- Analyzed teacher prepared lesson plans and technology project rubrics, in order to enhance the infusion of technology into the learning process.

- Completed classroom observations, and teacher interviews in order to enhance the infusion of technology into the learning process

- Completed individual classroom interventions that directly involved the integration of technology into the learning process.

Post intervention data indicated that improvements were made regarding technology staff development instructional strategies. Based on document analysis and classroom observations, the information presented through technology staff development, teacher interviews and specific classroom interventions made a positive impact in the correct use of technology.

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CHAPTER 1

PROBLEM STATEMENT AND CONTEXT

General Statement of the Problem

The students and staff of the targeted high school exhibit signs of inappropriate use of technology to advance student achievement. Evidence for the existence of the problem includes teacher observation of technological oversimplification (i.e., a lack of understanding concerning the processes and role of technology in learning), class projects that involve some aspect of technological employment, and the current problems with many students' approaches to researching the Internet.

Local Setting

Student Demographics

A quick comparison of the district and high school demographics presented in Table 1 will confirm that the high school is basically a microcosm of the district.

A summary of the student demographics of the targeted high school manifests a number of important distinguishing and defining characteristics.

First, the population is almost entirely White in terms of race. Second, only 3% of the constituents are considered to have come from "low income" families. Third, student mobility is relatively low. Last, the attendance rate is relatively high.

Table 1

Student Demographics of the District and High School

	District	High School
Total Enrollments	967	307
White	98.4%	98.4%
Black	1%	1%
Hispanic	3%	.3%
Asian/P. Islander	.3%	.3%
Native American	0%	0%
Low Income	3%	3%
Limited-English-Proficient	0%	0%
Dropouts	0%	0%
Attendance	97%	96.7%
Student Mobility	5.2%	3.3%
Ave Class Size	22.2	22.2

Staff Demographics

Table 2 juxtaposes the staff demographics of the district with the staff demographics of the high school for the 1996-97 school year. However, more recent trends in the staff demographics at the targeted high school for the 1997-98 school year are the following. First, the targeted high school hired five new teachers (replacing four regular positions and adding one new position) for the 1997-98 school year. This means that 20% of the staff are new to the high school. Considering the relative stability of teacher employment at the school, this type of turnover is somewhat of an anomaly. Second, in terms of teachers with master's degrees, the current demographics of the targeted high school do not show that eight high school teachers are currently enrolled in post graduate programs. This too, will change the demographics of the targeted high school in a notable manner.

Table 2

Staff Demographics of the District and High School

	District	High School
Teachers with Bachelor's Degree:	60.2	16.5
Teachers with Master's & Above:	39.8	11
Average Teaching Experience:	15.3 Years	12.98
Pupil-Teacher ratio:	14.6:1	10.9/1
Pupil-Admin Ratio	214.9-1	200/1

Facility

The targeted high school is part of a unit district comprised of an elementary school and a building that houses the junior high and high school. Although the junior high and high school share the same library and cafeteria, they each have their own classrooms in separate parts of the building. The junior high is in the east third of the building and consists of ten core classrooms, one computer lab, and a special education facility. The high school is in the west two-thirds of the building and consists of 13 core classrooms and the following additional facilities: a technology center with four educational areas and a distance learning lab, one family consumer science lab, two gymnasiums, two technology education labs, one art lab, two science/biology labs, a band and chorus facility, a special education room, and a reading resource center. This building also contains the district, guidance, junior high and high school offices. Due to their different schedules and locations, the high school and junior high students stay basically separated from each other throughout the day.

Academic Program

Students in the graduating class of 1998 must earn a minimum of 27 credits in order to graduate from the targeted high school. Three credits must be earned in English, three credits in mathematics, two credits in science, one credit in recent American History, one credit in Modern American History, one credit in World History, one-half credit in Contemporary Issues, one-half credit in Consumer Economics, one-half credit in Health, one-half credit in Speech, one-half credit in Driver's Education, one-half credit in Keyboarding, one-quarter credit for community service, and one-quarter credit in Physical Education.

One distinguishing characteristic of the targeted high school's academic requirements is its community service course. The community service requirement generates one-quarter credit towards graduation and requires that each student work in an approved program of 40 hours during their four-year high school career.

Required subjects are usually earned in the following years. Freshmen students must take English, mathematics, science, Computer Applications, Modern American History, Health, and Physical Education. Sophomores must take English, mathematics, science, World History, Speech, Drivers Education, and Physical Education. Juniors must take English, Recent American History, and Physical Education. Seniors must take Resource Management, Contemporary Issues, and Physical Education.

The targeted high school employs the eight block scheduling system. The eight block is a schedule based on an A-B day scheduling. Each day has four periods lasting

85 minutes along with a 25-minute activity period each day. An activity period is used for meetings for clubs and study time. The activity period is also used for students to "catch up" with their homework, if they missed a day of class.

The targeted high school offers a variety of vocational classes including Home Economics, Industrial Technology, and business courses. In many of these courses, the high school has an articulation agreement with the local community college.

Students at the targeted high school have several opportunities to obtain college level credit while still in high school. The high school offers distance learning to its students and to other area high schools via fiber optics and the local community college. Students at the high school have the opportunity to take college level entrance English classes, which are offered as part of the high school English sequence. Through distance learning, students may also obtain high school credit in program areas that are not offered by the local district.

The targeted high school has a Tech-Prep Team that has been instrumental in designing and implementing several Education-To-Career programs. The school has a large number of students involved in school-to-work programs as well as extra curricular activities.

The Surrounding Community

The school district serves a rural area encompassing 67.25 sq. miles. The village of 2,200 serves as the primary community. The total population the district serves is approximately 6,000. The district buses 66% of its student population of 967.

The targeted community is a rural town of 2,200 located in Central Illinois just 15 miles from the Peoria Metropolitan area. The community is a blend of farm and suburban bedroom communities. The rural population still outnumbers the village population by about 350, but only 8% of the community rely on agriculture for employment. There are 1,680 households within the targeted school district with 808 of the households located within the village. Recent demographics indicate that 56.9% of these households are made up of one or two people. Approximately 47% of the households have children under the age of eighteen. About 34% of the households have occupants 65 or older. A noteworthy statistic is the fact that 81% of the students of the targeted district live in traditional two-parent homes. Furthermore, 96% of these homes have at least one parent employed. About 52 % of the people in the community work in white-collar professional and technical areas (see Table 3).

The community is considered to be rural and agricultural, yet 52% of the people are professional and technical employees. Farmers make up only 8% of the population (see Table 3).

Table 3

Community Demographics

Community Demographic	Statistic
Household Income	
Median Household Income:	$36,320
Income Less than $25,000:	32%
Income between $25,000-75,000:	60%
Income over $75,000:	8%
Employment	
Professional & Technical:	52%
Laborers:	16%
Craftsmen:	14%
Service:	10%
Farming:	8%
Family Employment	
Both Parents Employed:	49%
One Parent Employed	47%:
Both Parents Unemployed:	4%
Education	
College Degree:	15%
High School Diploma:	66%
No High School Diploma:	19%
Culture	
White Population	5,332
Black Population	0
Asian Pacific Islander Population	5
Hispanic Population	50

The fact that 92% of those employed are employed outside of farming indicates the community is changing from a rural community to a more suburban community. Culturally, the population is clearly a Caucasian community as 98% of the population falls into this category. The Hispanic population makes up the largest minority group within the local community, but it is relatively small (see Table 3).

School Community Issues

In an interview with the principal of the targeted high school, the following issues were discussed as issues that have some bearing on the targeted high school.

The familial and religious composition of the community is beginning to change. What was once a community with a majority of Apostolic Christians and traditional two-parent families is beginning to become a community with multi-religious influences and single parent families.

A proposed tax cap for the county is also a concern. The targeted high school administration feels this will restrict the school's available monies if passed. Present resource monies must be spent carefully at this point in case the voters pass the tax cap.

Teacher turnover is very limited at this targeted high school as evidenced by the average teaching experience of 15.3 years. Less turnover shows that the targeted district is well established and is a relatively desirable school in terms of employment.

The targeted high school is open to employing new ideas and proven educational strategies. The eight-block schedule has been put in place, many teachers are obtaining their master's degrees, and the district has one of the best computer/distance learning labs in the area.

The fact that the housing costs are relatively high within the community causes a restriction on what socio-economic groups are able to move into the community.

Technology is valued at the targeted school district. For example, the targeted high school recently constructed a new technology center and hired a technology coordinator. In addition, the elementary school has a computer lab with a software specialist, while the junior high has its own computer lab with a part-time lab supervisor. Amazingly the targeted district has been able to keep its technology labs on the cutting edge while keeping educational spending in check.

National Context

The fact that many schools across America are focusing on implementing technology in the learning process can be easily documented. Indeed, President Clinton has endeavored to make the issue of acquiring computer technology for public schools a national priority (Knickelbine, 1997). In addition, American businesses increasingly demand that students come to work with previous experience with computer technology (Fulton, 1998). Since one could argue that the ultimate goal of education is to equip students for successful lives in the world of work, high schools and colleges feel pressure to provide a variety of technological opportunities for students. Hence, many schools are spending an increasing amount of money to equip computer labs with the latest high-powered computers and software in order to meet the expectations of the public and businesses (Knickelbine, 1997).

Though the current zeitgeist in American public schools could be likened somewhat to a technological gold rush, few educational pundits seem to be asking the more difficult questions about the pedagogical effectiveness of computer technology as measured by student achievement. Since student achievement is at the heart of all well-reasoned educational endeavors and is inextricably bound up with the success of the school, computer technology must be assessed, at least in part, on its effectiveness to facilitate student achievement. Unfortunately, many people erroneously equate the employment of computer technology with student achievement. The fact of the matter is that when students use computer technology it does not automatically translate into higher student achievement. Debra Vaidero (1997), in an article in Education Week, cogently argues this precise point when she writes "Many educators are banking on the belief that technology improves student achievement. In reality, though, research on its effectiveness offers, at best mixed results" (p. 12). Contrary to popular opinion, the research on the impact of computer technology on student achievement shows both failures and successes.

A recent study of one school district in Michigan showed that student achievement actually declined when computer technology became widely available.

> In 1995 the Detroit Free Press reported that Michigan Educational Assessment scores in the Romulus, Michigan, school district dropped to rank near the bottom of the metro Detroit districts. The decline came after a three-year, $24 million investment in computerized integrated learning systems. (Knickelbine, 1997, p. 71)

Furthermore, a recent study done to assess the effectiveness of a three-year, 14.1 million dollar investment by five New York counties showed that the schools' investment in computer technology did not significantly facilitate student achievement (Knickelbine, 1997). Studies like these demand that the cost effectiveness of implementing computer technology in education be thoroughly investigated.

Nevertheless, other studies show more positive results of computer technology on student learning. One recent study found that students who used computers to solve mathematical word problems

> did as well as students in traditional classroom at solving standard, one-step word problems. But they were significantly better than children in the control group at solving multistep word problems—the kind of complex reasoning that many education reformers say is so important. (Viadero, 1997, p. 13)

Another recent study of 36 California schools indicated that students who participated in a computer-aided science program "outscored students in traditional classrooms on their grasp of some scientific concepts" (Viadero, 1997, p. 13). In addition to these positive findings, some pundits believe that inner-city students have been greatly helped in their learning via computer technology (Viadero, 1997).

While the present state of understanding concerning the effectiveness of computer technology on student achievement is deficient of persuasive and comprehensive evidence (Trotter, 1997), to be sure, the public perception concerning the effectiveness of computer technology on student learning is at a notable high. According to a recent poll conducted by Phi Delta Kappa and The Gallup Organization (1996), many people feel that the employment of computer technology in the learning process in public schools could significantly strengthen education in America. For example, the poll reported that "there are those who feel that greater use of technology is the answer to many of the problems facing the public schools. The public expresses strong support for providing schools with access to global electronic communications systems" (Elam, et al., 1996, p. 53). This report claims that 80% of the survey's respondents think that computer technology is either very important (41%) or somewhat important (31%). Furthermore, the report states that "teachers place computer skills alongside the three R's, hard work, citizenship, and history and geography as essentials in public school curriculum" (Elam, et al., 1996, p. 53). However, all of the excitement may be premature. After the initial rush of enthusiasm wears off, the philosophers, principals, superintendents, members of the board, teachers, parents, and students must ask the hard, nagging question: Specifically, how does the use of technology in the learning process facilitate student achievement? Perhaps the public school's present infatuation with computer technology needs to be tempered by this poignant and cogent caveat:

> Let's face it: Computers have so far had only a lackluster impact on student achievement in general. If we don't want to see the plug pulled entirely, what is needed is a far more critical and discerning attitude toward computer-based instruction.... Only when demonstrated effectiveness in improving student learning becomes the central criterion...will schools begin to redeem the true promise of educational technology. (Knickelbine, 1997, p. 71)

CHAPTER 2

PROBLEM DOCUMENTATION

Problem Evidence

To document the extent of technology oversimplification, the following data collection methods were used; staff survey (See Appendix A), staff interview (See Appendix B), and document analysis (See Appendix C). During the first week of school, staff members were surveyed in order to collect base line data. Of the 24 surveys distributed, 18 were returned.

The first evidence of technological oversimplification was indicated by the teachers' survey data that showed student interest in technology was higher than that of the teachers' interest. Figure1 gives a comparison of student interest in technology versus teacher interest in technology. Teachers were asked, "What is the level of student interest, involvement, and commitment to using technology to enhance teaching and learning in their teaching assignments?" (See Figure 1) Seven teachers felt that most students were interested, involved, and committed to using technology; whereas only two teachers responded that most teachers were interested, involved, and committed to using technology to enhance teaching and learning. (See Appendix A) The differential in technological interest also suggested a situation where students were more interested in using and deploying technology than were the teachers. These data suggested that teachers felt threatened by a learning environment where students were more technologically adept.

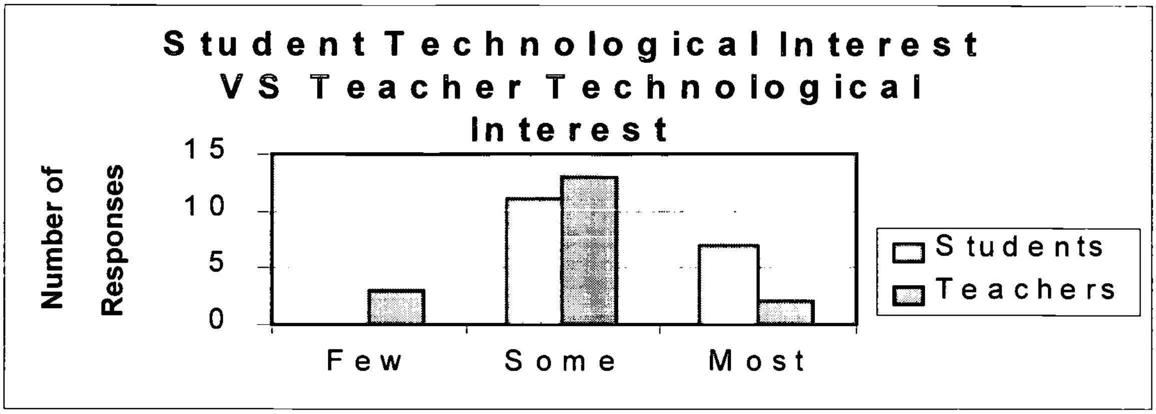


Figure 1. Student technological interest versus teacher technological interest as reported by teachers within the targeted high school.

Teachers on the teacher survey also provided evidence for the problem of technology oversimplification. When asked if they (the teachers) had used technology to provide learning experiences for students that would otherwise be unavailable (i. e. simulated lab experiments, virtual field trips, problem-solving situations, simulations that stimulate higher level thinking skills), thirteen teachers responded that they had used little or no technology in order to provide these types of learning experiences.

The problem was also evidenced regarding the ability of technology to provide for individual student learning. When teachers were asked, if the use of computer technology in the classroom had allowed them to increase attention to individual student learning, only one teacher responded definitively that technology had allowed her to increase attention to individual student learning. Six teachers indicated that technology had in some cases allowed them to increase attention to individual learning.

Table 4 indicates that teachers felt overwhelmingly that the infusion of technology into the learning process was important (somewhat important, eight responses or very important, ten responses) (See Appendix A). Yet, on the average, less than half of the teachers (35%) perceived fellow teachers using technology in their instructional strategies (See Appendix A).

Table 4

How Important is the Infusion of Technology into the Learning Process, Teacher Survey Question 19

Indicator	Not important at all	Not too important	Somewhat important	Very important
Number of responses	0	0	10	8

On technology staff development issues, teachers felt that technology staff instruction was mainly technical skill training and this instruction was not providing practical applications (See Appendix A). Ten of 14 (71%) teachers responding felt that technology staff development was mainly comprised of technical training with little emphasis on practical classroom applications and instructional pedagogues. Only three teachers felt that the district technology staff development provided practical classroom applications, and only one teacher felt that staff development included both practical applications and instructional strategies. (See Figure 2)

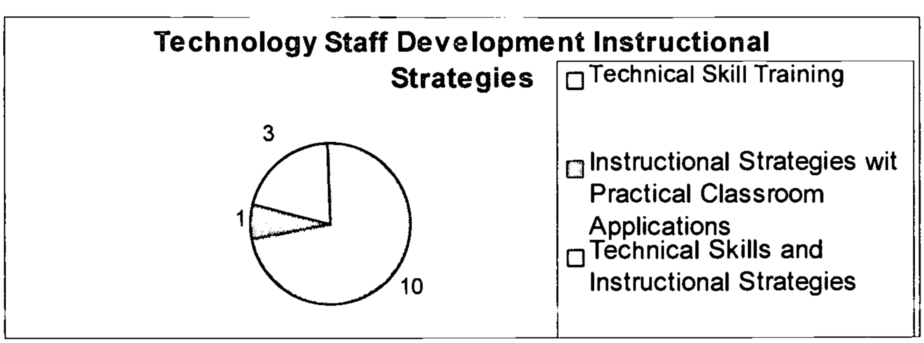


Figure 2. Staff development instructional strategies.

During the interview teachers provided several instructional examples of technology oversimplification (See Appendix B). Some of the responses are documented in Table 5. Teachers cited problems within their instructional practices as well as with student products and processes. Teachers also indicated that the current technology staff development was not meeting the individual needs of the instructor.

Table 5

<u>Teacher Cited Technology Oversimplification Sept.1, 1998 Through Sept. 30, 1998</u>

Cited Example	Number of teachers responding
Using Power Point (or other) for glitzy presentations that overshadow the underlying learning processes and or content.	2
Students make some grammatical and mechanical errors in writing when they use a word processor-but think their paper is better because it is printed neatly from a word processor.	1
Students use multimedia sizzle as a substitute for content.	2
Its time to move past "how to" and move towards practical classroom applications.	2
Staff development is directed towards the staff as a whole, whereas, each of us needs individual direction.	1
Students have very little input into the direction of their learning, due to teacher assessment techniques and specifications. An example is poorly designed rubrics that limit student creativity and or student directed learning.	1

<u>Note.</u> The number of responses indicates responses of similar content by different interviewees.

Document analysis (See Appendix C) also revealed evidence of technological oversimplification. Teachers rarely supplied the researcher with evidence of the correct use of technology within their written lesson plans and or assessment rubrics. The following elements were often found to be missing; practical real world applications for content covered, constructivist learning techniques, higher order thinking skills, student-to-student peer review, and hyper-homework. In conclusion, the researcher found that in most cases teachers stressed the technology components, while overlooking the elements of the learning process.

Finally, comparative to teachers not providing proper instruction in the learning process, the researcher, through informal classroom observations, was also able to document learning experiences where the students were not given the proper technological instruction necessary to complete assigned tasks (Journal entries).

In conclusion, the integration of technology and learning has presented a different learning environment for both teachers and students at the targeted high school, and the problems created by technological oversimplification was evident in the teacher surveys, interviews, and document analysis.

Probable Cause

Site-Based

Just as the evidence pointed to multiple examples of technology oversimplification, so did the site-based probable causes point to multiple causation. To document the site-based probable causes of technology oversimplification, the researcher used staff interviews (See Appendix B). Teachers were asked a follow-up question to a previous problem evidence question documented earlier. They were asked, "What do you perceive as the underlying causes for the existence of technology oversimplification in your cited examples?" Some of the responses are documented in Table 6. Teachers cited causes related to students, local school district, staff development, time, and themselves.

Table 6

Teacher Cited Causes of Technology Oversimplification Sept.1, 1998 Through Sept. 30, 1998

Cited Example	Number of Teachers
Students have not been taught to think critically about sources and credibility.	3
Students have grown up with technology	2
Students are using technological products to replace the learning experience. Technology has become the ends to the means.	1
Students do not know how to critically evaluate Internet material.	2
Teachers expect students to use technology without proper instruction, i.e. Internet use.	1
Teachers do not see the connection between software and their curriculum.	1
Teachers do not provide technological instruction necessary to accomplish stated outcomes.	3
Teachers assess technological product rather than assessing the process.	2
Teachers use technology to show off.	1
Teachers feel threatened by the level of expertise of the students and feel uncomfortable teaching the technological content.	2
Teachers force students to use technology when other media may provide a better learning process.	2
High emphasis placed on using technology.	3
Teachers have not been trained as to the role technology plays in the learning process.	1
Teachers do not have the time necessary to develop lesson plans that utilize all the capabilities technology has to offer.	2

Note. The number of responses indicates responses of similar content by different interviewees.

In summary, the local causes for the problems evidenced could be classified into four categories: student learning, teaching and instruction, teacher training, and continual student exposure to technology outside the walls of the school.

Probable Cause

Literature Based

The growing number of books and specialized journals dedicated to the purpose of exploring issues related to the use of technology in education is indicative of the spirit of the times. Presently, much is being said by techno-critics, and many more voices are rushing to enter the academic conversation that is presently being fleshed-out in writing. The vast amount of literature currently being generated about implementing computer technology into the classroom lucidly manifests multiple factors of causation for technological oversimplification. A large part of the current research being published concerning the implementation of computer technology in the classroom suggests a bifurcation into two major areas of concern: student issues and teacher issues.

When examining student issues and the implementation of technology in learning, educators are quick to note that many students do not understand the role of technology. Students see technology as a free time activity; for example, students are often introduced to computer technology via computer games. According to Debra Viadero (1997), "the most frequent use that 4th graders make of computers is to play games. For 8th graders, playing games is the second most common use, behind writing papers" (p. 15). Consequently, many students perceive computers primarily as a tool for entertainment rather than education--though the two are not necessarily mutually exclusive. Thus, Viadero (1997) warns, "Teachers . . . have to be careful not to let the fun quotient overtake serious learning" (p. 13). Further evidence that students frequently misunderstand the role of computer technology in learning can be found in a statement by technology researcher Barbara Means. Means cogently laments that some students will spend "a whole period illustrating a color cover of a report, pixel by pixel, when they haven't even done the report yet" (as cited in

Viadero, 1997, p. 13). Though many students are enthusiastic about using computers in school, unfortunately, it seems that a considerable number of students do not yet understand the broader, more important role that computer technology can play in their education.

A problem that some students encounter when they seek to employ computer technology as a learning tool is that, a computer-based learning environment is primarily a self-directed/constructivist approach to education "that places the responsibility for learning on the student" (Umphrey, 1998, p. 4). Tapscott (1998), chairman of the Alliance for Converging Technologies, confirms that in the computer-based classroom, the role of the student shifts from that of empty vessel waiting to be filled by a teacher's instruction to interactive, engaged learner. This shift can be problematic for some students because they may have been conditioned for years to function in a more essentialistic/teacher-directed learning environment. The results are both exciting and frustrating for students. Because computer-based learning puts the student in charge of his or her learning, the student often encounters a contradictory sense of empowerment and fear. Tapscott (1998) laments the fact that, more often than not, the shift in learning paradigms (from teacher-centered to student-centered) is not done effectively.

Though the general consensus of the analysts accentuates the virtues of the interactive learning that happens when students direct their own learning via computer technology, the fact remains that, because of years of conditioning, some students find this new approach threatening--or at least unwelcome. Indeed, the constructivist approach to learning requires students to actually be engaged in authentic higher order thinking, whereas in the essentialistic approach to education, students could often merely parrot back to the teacher whatever they thought the teacher wanted to hear or read. Thus, under this new educational paradigm, students are required to think, work, and learn where before they could simply read, take notes, and regurgitate information back to the teacher in oral or written form. Some students may be reluctant to engage in self-directed learning via computer technology precisely because it requires them to take responsibility for their own learning.

A second major area of concern related to problems with implementing computer technology into the learning process focuses on teacher issues. Unfortunately, many teachers, including many seasoned veterans, have had little or no training in using computers effectively in their teaching. Some teachers suffer from technophobia--or worse; they are hostile toward computer technology. According to Kathleen Fulton, associate director of the University of Maryland's Center for Learning and Educational Technology, computer technology poses a special problem for teachers today:

> Technology is a special case. It isn't something teacher's got in their preparation. We assume teachers know about content and pedagogy, and we expect them to stay up to date in those areas. But they have not been prepared to think about how technology can enhance their teaching. (Trotter, 1997, p. 7)

Because of this lack of training, some teachers suffer from technological oversimplification. That is, they have the misunderstanding that if the school provides computers for students to use, then they will automatically engage in learning. However, Stephan Marcus, co-director of the South Coast Writing Project and a researcher at the University of California-Santa Barbara, warns that "to provide a computer and think that students' writing will somehow magically improve--that's just wishful thinking" (Viadero, 1997, p. 13). Furthermore, technology coordinator Stephen Carr gives educators this caveat:

> There's a real misconception that you find a piece of software, you put it on, and you let kids play on it. It is just wishful thinking that to provide computers, software, and/or

connectivity that learning will magically take place. (Viadero p. 16)

Complicating this problem is the fact that teachers are so busy with their regular teaching duties that they do not have the time for computer technology training. John D. Bransford, professor of psychology at Vanderbilt University, states that "professional development is the biggest bottleneck to the implementation of the new technology in schools, and the reason is that teachers are so busy" (Zehr, 1997, p. 26). Indeed, once teachers are certified, they are lucky if they can find the time for any training at all, let alone time for designing integrated technology lesson plans. There is a definite lack of release time for teachers planning for technology that utilizes modern approaches to teaching. Furthermore, Lockwood (1998) confirms that the greatest obstacle to teachers using computers is the lack of time for planning and incorporating such a sizeable innovation into their practice. When it comes to the implementation of computer technology into the classroom, Alfred North Whitehead's words seem relevant: "Lack of time is the rock upon which the fairest of educational schemes are wrecked" (as cited in Lorber, 1996, p. 9).

Another important issue related to teachers is the inevitable shift in the teacher's approach to teaching. In the computer-oriented classroom, the shift is from teacher-directed education to student-directed education. Thus, the traditional essentialistic/teacher-directed philosophy of education comes into confrontation with the constructivistic/student-directed philosophy of education. This philosophical shift in approach to education has been less than accepted by many veteran teachers. Michael R. Haney, a program director for funding teacher training projects at the National Science Foundation, confesses that he went into teaching years ago because he "liked giving a lecture and having a stage presence" (as cited in Zehr, 1997, p. 24). Haney posits that "We're taking teachers and trying to transform them into something very different than what they signed up for" (as cited in Zehr, 1997, p. 24). Because the employment of computer technology demands that teachers venture away from the traditional, familiar lecture, many veteran teachers immediately feel uncomfortable. Haney further explains his initial frustration with using computer technology in the classroom when he explains, "There was nothing about my [teacher] training that taught me how to have kids go in eight different directions" (as cited in Zehr, 1997, p. 24). Zehr (1997) concurs with Haney and makes it extremely clear when she writes, "Teachers who use technology also must learn how to manage their classrooms differently. They need to become comfortable with different students doing different activities at the same time . . ." (p. 24). The question is whether or not veteran teachers will make the change from lecturing teacher to the guide on the side of the student.

Implementing computer technology into the classroom is not a problem-free task. In fact, employing computer technology in education has created some new but worthwhile problems. As the maxim goes, "You get to pick your problems. You do not get to pick them to be problem-free." If computer technology is to be used effectively in education, students and teachers must learn to successfully negotiate the challenges that computer technology presents to them.

CHAPTER 3

THE SOLUTION STRATEGY

Literature Review

The sheer volume of up-to-date literature has made the task of reviewing the literature on the impact of technology on student achievement both easy and difficult. Finding a technology expert who was willing to share an opinion on the subject at hand was as easy as walking to the school mailbox and sorting through the myriads of journals dedicated to educational technology or doing a simple search on the Internet. However, the volume of articles, journals, and books turned out to be a two edged sword: sorting, classifying, and finding usable material for this project was all the more cumbersome precisely because of the volume. In addition, so much information about the employment of technology in education is currently being discussed that without a constant attempt to keep up with the discussion, one could easily find that relatively "new" ideas quickly become passé. At this point, it is difficult to resist thinking of the researcher as a swimmer trying to keep from drowning in a sea of literature. Wave after wave of documents brings more and more information for the weary researcher to negotiate. The nature of this inundation of literature about computer technology is representative of the current prolific state of technology in our culture.

While the current literature is indeed vast and often unruly, the current disposition of the writing dedicated to implementing computer technology into education is strongly optimistic. At this time, America is riding a strong wave of support for employing computer technology in schools. This is not to say that educational technology does not have its opponents and doubters. However, they currently have a small and relatively insignificant voice in the present academic conversation being conducted via books, articles, and journals. It is probably more accurate to say that at this time in America the two biggest schools of thought concerning the pedagogical value of technology are not those who believe that computer technology enhances learning and those who do not, but, rather, there are those who are openly endorsing the use of computer technology as an important tool in the learning process, and there are those who are cautiously optimistic about how technology is implemented in the educational system.

In the literature, one can find a multitude of solutions to the problems that computer technology creates in educational settings. Euphoric anecdotes about how schools are successfully using computer technology in the learning process are common. Consequently, a number of technology experts have cogent solutions to offer. The following solutions are offered in the context of the specific problems that have already been raised at the end of chapter two concerning student issues and teacher issues.

Because some students do not understand the broader, more important role of technology in learning, they must be systematically trained to understand this role. Indeed, Viadero (1997) stressed the fact that students must be challenged to think of using computer technology to learn rather than solely as a means of entertainment. In Learning with Technology, Margaret B. Tinzmann and her colleagues (1997) concurred with Viadero that computer technology in the classroom offers students rich opportunities to enhance learning. Furthermore, Tom King (1997), editor of Technology in the Classroom, believes that though technology alone could not make learning success happen, learning success cannot happen very well unless students have access to the technological tools they need. In his article, he postulated that computer technology was an empowering tool that encouraged students to engage in authentic learning. While employing computer technology is clearly not a panacea for pedagogical pathologies, this tool is effective for learning, and all students should be well aquatinted with any tool that helps them to learn. Therefore, students must be challenged and trained to think of computer technology as a learning tool, not as a tool solely for entertaining themselves.

One possible solution to helping students understand the role of computer technology is to show them how computer technology can prepare them for future employment. According to International Business Machines employee and consultant Harvery Long (as cited in Szabo and Hotch, 1993, p. 65) at least 85 percent of all current jobs involve technology. This kind of pertinent information screams for the attention of educators and strongly appeals to students' seemingly innate need for an education that is relevant and up-to-date. In the 1998 edition of <u>Learning with Technology</u>, Educational reformers Robert Kozma and Patricia Schank boldly echo Long's sentiments when they stated that:

> Students will need to acquire a new set of skills. They will need to be able to use a variety of tools to search and sort vast amounts of information, generate new data, analyze them, interpret their meaning, and transform them into something new. They must have the ability to see how their work fits into the larger picture, to understand how the pieces work together and to assess the consequences of any changes. They must develop the capacity to work with others to develop plans, broker consensus, communicate ideas, seek and accept criticism, give credit to others, solicit help, and generate joint products. (Dede, 1998, p. 4)

In the United States, children between the ages of 2 and 11 spend an average of 28 hours per week in front of the television, and teenagers spend about 23.5 hours weekly watching TV.

In contrast, only 29% of U. S. students spent 14 or more hours per week doing homework. Time spent at home represents a significant resource for student learning and can be particularly valuable if parents are involved. Technology can play an important role in connecting the school community and the family (Dede, 1998).

Infusing computer technology into the learning process can facilitate the internalization of the specific skills mentioned by Kozma and Schank (as cited in Dede, 1998); however, for students to perceive computer technology from this broader, more enlightened vantagepoint, they must be trained to see the computer not merely as a means of entertainment, but as a means of learning. Eric Hoffer (as cited in King, 1997) cogently argued that only learners, not the learned, will inherit the future.

Employing computer technology in the learning process also enables many students to take personal responsibility for their own education. While such proposition strikes fears in the hearts of some students, many others welcome the opportunity to take ownership of their learning. Tapscott (1998) wrote that many in the generation of children growing up in the computer revolution actually prefer to use computer technology as a tool for learning. In addition, Umphrey (1998) noted that in the modern learning environment many new educational software programs require the student to take charge of his or her own learning. According to Viadero (1997), when students move from passive listener to active, engaged learner using technology to process information, student motivation soars. For the most part, the current literature is strongly optimistic about the fact that students who use computer technology in the learning process are self-directed students who are taking responsibility for and ownership of their education. The current literature seeks to substantiate the connection between the use of computer technology and student motivation to learn via anecdotal evidence.

In regard to teacher issues, technology experts are quick to offer multiple solutions. Current literature accentuates the need for teacher training. Indeed, technology experts almost universally agree that teacher training is absolutely basic and critical to the successful implementation of computer technology in classrooms. According to Zehr (1997), at least 30 percent of a school's technology budget should be spent on training for teachers to use computer technology effectively in their classrooms. Zehr further argued that teacher training is most successful when it offers hands-on learning opportunities to explore and when teachers have easy access to equipment and people who can explain how to use computer technology well in the classroom. Clearly, teacher training, in order to be successful, must be extremely practical and readily available. Furthermore, Zehr (1997) pointed out that for teacher training to be truly effective teachers must be involved in planning the training. However, in the real world where the public measures every dollar spent by schools, many schools do not enjoy the luxury of being able to spend 30 percent of the technology budget on staff development. Add to this the fact that teachers are already pressed to find time for many legitimate educational endeavors and the result is often little or no real effective training for teachers. Nonetheless, Trotter (1997) agreed with the pundits: teacher training is not an option for schools that are serious about successfully infusing computer technology into the learning process. Because teachers stand in the gap between students and the use of computer in the learning process, they will either facilitate or complicate the successful integration of computers in education. Therefore, the literature is weighty with advice and solutions about how to train teachers to use computer technology successfully in their classrooms.

A second teacher issue is that of changing teaching strategies from the teacher-centered/essentialist approach to teaching to a student-centered/constructivist approach. In

Technology-Based Learning: A Handbook for Teachers and Technology Leaders, Tweed Ross and Gerald Bailey (1996) wax eloquent when they refer to the fact that the role of the teacher in a technology-rich environment must necessarily shift from being the "sage-on-the-stage" to being the "guide-on-the-side" (p. 22). Zehr (1997) argues that some teachers are simply not willing to make this kind of change in their approach to teaching. Nevertheless, those teachers who are willing to change must embrace at least three different non-traditional teaching roles that Tinzmann and her colleagues (1997) have identified: facilitator, guide, and co-learner/co-investigator. As a facilitator, the teacher's task is to facilitate learning by creating an environment in which students can solve problems, do authentic tasks, and collaborate. As guides, teachers are involved in mediation, modeling, and coaching, especially as students begin their inquiry. As co-learners and co-investigators, teachers are involved in learning right along side of the students. When teachers change their functional educational philosophies, then these teachers will be in a position to use computer technology effectively in their classrooms.

The subsequent action plan demonstrates a shift in functional educational philosophies (from essentialism to constructivism) that teachers must initiate if they desire to implement technology effectively in their classrooms. This action plan accentuates key tenets of the constructivist approach to teaching and learning as outlined by Brooks and Brooks (1993). For example, the first step in the action plan calls for the teacher to gather baseline data. The primary reason for this first step is so that the teacher may facilitate students' learning. Indeed, it behooves the teacher to gather baseline data so that he might be able to intelligently create a learning environment where students can function as inquirers and construct their own knowledge (Joyce and Weil, 1996). Second, the following action plan calls for the teacher to function as a guide. It calls for the teacher to guide students in a self-directed learning journey using technology to achieve specific content objectives. The technological classroom serves as the location in which the teacher guides students by modeling and coaching students as they employ various aspects of technology to learn. Finally, the action plan provides, through technology staff development, current best practices, and research proven technologically enhanced instruction. The technology staff development action plan also provides an avenue for teachers to locate information and integrate lessons into their current curriculum. The action plan is designed to help the teacher learn about how to effectively help students achieve via computer technology. Through writing reflective logs and gathering post-intervention data, teachers can gain insights into teaching, students, and using technology in the learning process. Clearly, then, the action plan, though it contains some elements of essentialism (i.e., direct instruction), is rooted in constructivist ideas and best practices.

What does the technology teacher-centered learning classroom look like? According to Ross and Bailey, Technology-Based Learning: A Handbook for Teachers and Technology Leaders, (1996) it is a classroom where teachers take risks in preparing lessons with technology; teachers lead attractive, exciting activities with technology; teachers address a variety of student needs and learning styles; and teachers use their multimedia expertise to author and experiment.

Without a doubt, the infusion of technology into the American classroom creates new concerns. However, there is a plethora of literature about how to solve most problems. The literature about employing computer technology into classrooms is saturated with solution-oriented articles and books. What remains to be seen is whether or not the solutions offered by the authorities in their euphoric journals can be generalized to different school systems throughout the country.

Project Objectives and Processes

As a result of infusing technology into the learning process during the period of September 1, 1998, to February 1, 1999, the targeted staff and students will increase their abilities to use technology to increase student achievement, as measured with teacher surveys, interviews, classroom observations, and document analysis.

In order to accomplish the project objective, the following processes are necessary:

1. Provide technology staff development that offers hands-on learning, provides opportunities to experiment, promotes practical classroom applications, links technology to the curriculum, illustrates constructivist ideas, and encourages higher levels of student thinking.
2. Prepare a technology staff development curriculum that addresses three different levels of technological instruction and introduces the idea of technology coaches.
3. Develop and complete document analysis of teacher prepared lesson plans and technology project rubrics in order to enhance the infusion of technology into the learning process.
4. Develop and complete classroom observations and teacher interviews in order to enhance the infusion of technology into the learning process.

Project Action Plan

The action plan was divided into three main categories: data collection, classroom interventions, and staff development activities. Data collection included a teacher base-line data survey, final data teacher survey, document analysis, and teacher interviews (See Table 7). Classroom interventions included specific interventions in several different classrooms including two homework assignments (See Table 8). Staff development activities included interventions developed and implemented within the existing technology staff development program (See Table 9).

Table 7

Project Action Plan Data Collection

Process/Activity	Teacher	Time Line	Location (Class)	Responsible Entity	Content Area	Instructional strategy
Teacher survey and analysis (base data)	All	Sept. week 1,2	Workshop	Researcher	Staff development	Data collection
Teacher survey and analysis (final data)	All	Jan. week 1,2	High school	Researcher	Staff development	Data collection
Document Analysis	Math Drafting English	Oct-Jan	Classroom	Researcher/ teacher	English Math Drafting	Data collection
Teacher Interview	All	Sept-Jan	High school	Researcher	All	Data collection

Table 8

Project Action Plan Classroom Interventions

Process Activity	Teacher	Time Line	Location (Class)	Entity	Level	Content Area	Instructional Strategy
Alge-Blaster 3	Math	Nov. Week 1-4	Math lab	Math teacher	2	Math	Higher level thinking skills
Word processing with technology element	English	Sept- Dec.	English I	Researcher teacher	2	Writing	Technology and learning
The Cay	Literature	Sept. Week 4	Sixth Grade/	Technology coaches	3	Literature	Constructivist learning activity
Multimedia Calculus	Math	Dec. week 1,2	Math lab	Math teacher	3	Pre Calculus	Higher level thinking skills
Hyper-homework (Internet collaboration)	Math	Dec. week 3,4	Math lab home	Math teacher Tech. coach	3	Algebra I	Higher level thinking skills
Hyper-homework (Desktop video)	English	Oct. week 3,4	English /home	English teacher	3	Greek Mytho-logy	Constructivist learning activity
Computer Aided Drafting	Drafting	Oct-Dec	Draft CAD I	Drafting teacher	2	Drafting	Technology and learning
Harriet Tubman WWW2.lhric.org/pocantico/tubman/tubman. html	Social Science	Sept. week 2	Fourth grade	Staff development team	3	Under-ground Railroad	Technology and learning

Note. "Level" column was used to categorize instruction and learning into three levels: Level one was using technology for presentation in the classroom; Level two was for technology classroom instruction where students used technology for simulations and applications; Level 3 was technology instruction that used higher level thinking skills and or constructivist pedagogy. Levels were not defined in terms of being sequential, that is level two did not build on level one, and level three did not build on level two.

Note. "Hyper-homework referred to homework that falls into level three technology instruction.

Table 9

Project Action Plan Technology Staff Development Activities.

Process /Activity	Teacher	Time Line	Location (Class)	Responsible entity	Level	Content Area	Inst. Strategy
Open Labs	All	Sept.-Dec.	High school tech center	Staff development team	NA	All	Access to technology hyper-homework
Technology presentations	All	Sept. Week 1	High school tech center	Staff development team	1	All	Using presentation technology in the classroom
Hyper-homework	All	Sept. Week 3	High school tech center	Staff development team	3	All	Developing hyper-homework lesson plans
Technology coaches	All	Oct-Nov.	High school tech center	Staff development team, Technology students	NA	All	Implementing technology coaching program
Global School Net Project	All	Nov	High school tech center	Staff development team	3	All	Lesson for extending the classroom
National Center for Technology Planning www.nctp.com	All	Dec	High school tech center	Staff development team	3	All	Lesson Planning
Transfer of technology to education (ITTE) www.nsba.org	All	Dec	High school tech center	Staff development team	3	All	Planning for technology and learning

Table 9 cont.

Project Action Plan Technology Staff Development Activities.

Process/Activity	Teacher	Time Line	Location (Class)	Entity	Level	Content Area	Inst. Strategy
Make the link to Illinois Learning Standards WWW.stclair. k12.us/makethelink/mlgrid.htm	All	Nov. week 1	High school tech center	Staff development team	2-3	All	Linking State Standards to lesson planning, mapping lessons to curriculum
Technology Connections NCREL www.ncrel.org	All	Nov. week 2	High school tech center	Staff development team	3	All	Practical technology integration lessons
Education World WWW.education-world.com	All	Dec. week 1	High school tech center	Staff development team	3	All	Lesson planning

Note. "Level" column was used to categorize instruction and learning into three levels: Level one was using technology for presentation in the classroom; Level two was for technology classroom instruction where students used technology for simulations and applications; Level three was technology instruction that used higher level thinking skills and or constructivist pedagogy. Levels were not defined in terms of being progressive, that is level two did not build on level one, and level three did not build on level two.

Note. "Hyper-homework referred to homework that falls into level three technology instruction.

Methods of Assessment

In order to assess the effects of the interventions, an analysis of the teacher survey final data was completed using likert scales, percentages, scattergrams, means, medians and modes. Furthermore, surveys, interviews, and document analysis was also used as a part of the assessment process.

CHAPTER 4

PROJECT RESULTS

Historical Description of the Intervention

The objective of this project was to increase student achievement through the effective use of technology. The implementation of a technology staff development program that provided practical classroom activities, hands-on learning, linked technology to the curriculum, illustrated constructivist ideas, encouraged higher levels of student thinking, and introduced the idea of technology coaches. The staff development component, which provided instruction based on a three-tier level, was selected to fulfill the staff development component. In addition, the use of hyper-homework was introduced through staff development classes. Staff interviews and document analysis provided instruction for effective uses of technology, as well as providing assessment of project results. Classroom observations were also used to assist in assessing progress.

Timeline

As stated in the action plan, the first task to be completed was the collection of baseline data. A survey of all high school staff was completed and analyzed (See Appendix A). This data collection took place during the first week of school. Technology staff development classes, related to the research project, were conducted in September and October. In all, there were four project-related technology staff development classes. Staff interviews were conducted the first two weeks in September.

Document analyses were conducted from the first week of September through the first week of November. Classroom observations were completed from September 1, 1998 through December 4, 1998. Individual classroom interventions took place throughout September, October, and November. Final staff surveys (See Appendix A) were conducted the week of January 11, 1999.

Staff Development

Staff development instruction was provided through an existing technology staff development program. All technology staff development classes were classified into three levels. Level one was using technology for presentation in the classroom; level two was for technology classroom instruction where students used technology for simulations and applications; level 3 was technology instruction that used higher level thinking skills and/or constructivist pedagogy. Levels were not defined in terms of being sequential, that is level two did not build on level one, and level three did not build on level two.

Specific staff development classes included, using the destination computer for classroom presentations (level 1), lessons with a taste of technology (level 2 and 3), linking state standards (level 3), and using the Internet for technology planning (level 3) (See Appendices E-H). Instruction was provided to demonstrate using high school students and technology staff as coaches for technology in the regular class (level 1-3).

Staff Interviews

Seven staff interviews were conducted (See Appendix B). Staff members with a history of integrating technology in their classrooms were selected for interviews. These interviews served to provide technological methodology instruction and for technology staff development direction. The interviews were also used to assess project progress.

Classroom interventions

The next phase of the action plan called for specific classroom interventions. The first classroom intervention activity was conducted in the high school math department in Basic Algebra. A software program called Alge-Blaster was used to teach and assess basic algebra concepts. The software program was used over a three-week period, for a total of eight class periods. The second classroom intervention occurred in a freshman English literature class where students were introduced to the Modern Language Association (MLA) standards and endorsements. First, the students were assigned an essay to complete prior to having been taught computer literacy skills. Then students were taught computer literacy skills in the computer lab where guided practice included using a word processor, spell checking, using printers, saving files, and closing programs and documents. This intervention consisted of ten class periods over a nine-week period. The third classroom intervention activity was conducted in a sixth grade literature class where students were reading the story The Cay. After reading the novel, students were assigned high school student-technology coaches. These coaches assisted groups of three or four students in the research of topics discussed in the book. The culminating activity was the construction of a web page illustrating student research. Each group of sixth grade students met with technology coaches four times, over a four-week period. The fourth intervention was conducted within a community college distance-learning calculus class. The intervention involved the use of a multimedia software program. The calculus program was used for four class periods in a two-week period. The fifth intervention took place in the Drafting Department, where instruction was given on Auto Cad. The Auto Cad program was taught over a nine-week period and the classes meet 18 times. The hyper-homework-desktop video intervention was not completed, due to a scheduling conflict with the desktop video equipment.

Documents Analysis

Document analyses were conducted to provide assistance to staff in developing effective lesson plans and projects using technology. The document analyses also provided assessment of project progress. In all 13 lesson plans, projects and/or rubrics were evaluated.

Classroom Observations

Classroom observations were conducted to assess project effectiveness. Five of the classroom observations directly corresponded to the document analysis of that specific lesson plan or rubric. The other seven observations were competed in randomly selected classes where students were using technology.

Presentation and Analysis of Results

Results of Document analysis indicated slight improvements over time in teacher-designed lessons and rubrics utilizing technology. The document analysis allowed the researcher to report on student behaviors, technological skills, and learning skills. Student behaviors were documented only if the respective teacher was available for comment. The percentages of responses in each category was recorded; the *none* and *fair* categories were considered unfavorable and the *good* and *excellent* categories were considered expedient. The results demonstrate a positive increase over time in the *good* and *excellent* rating categories. Whereas, in the percentage of responses in the *none* and *fair* categories, a slight decrease in percentages was detected. This slight decrease over time was a desired outcome. The numbers reported represent the percentages of responses for *none* and *fair* and for *good* and *excellent*. The responses (See Appendix C) were aggregated over two-week periods from September 1, 1998 through October 30, 1998 (See Figure 3). Two technology staff development classes were conducted during the first two weeks of September and may account for the significant growth between the first two weeks and the third and fourth weeks.

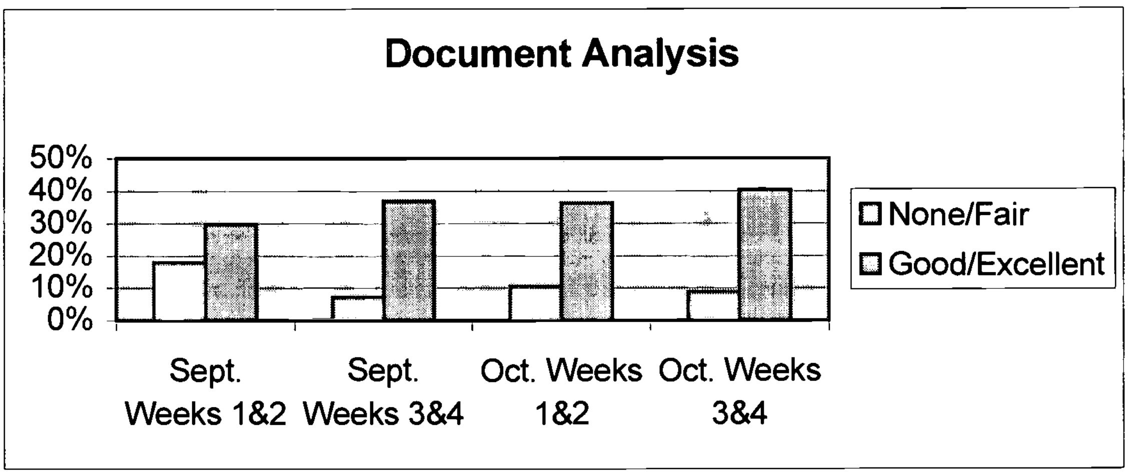


Figure 3. Document analysis results.

Similar results were recorded from classroom observations. Classroom observations were documented from the first week of September 1998 through the first week in December 1998 (aggregated in 4-week periods). In all, 12 observations were recorded. The researcher made observations as to student behavior, technology skills, and learning skills (See Appendix D). The *frequent* category was considered favorable and improvements in these criteria were considered positive. A negative growth in the *not yet* category was considered favorable. The *sometimes* category was considered to be a neutral criteria, hence not used to formulate conclusions. Overall, the data suggests slight improvements were made; however, the data was inconsistent. This inconsistency might have been caused by a low number of observations made, or possibly because of the inherent differences in the classes observed. The only common content criteria between the classes observed were that they all contained a technology component. Final analyses of classroom observation data are reported in Figure 4.

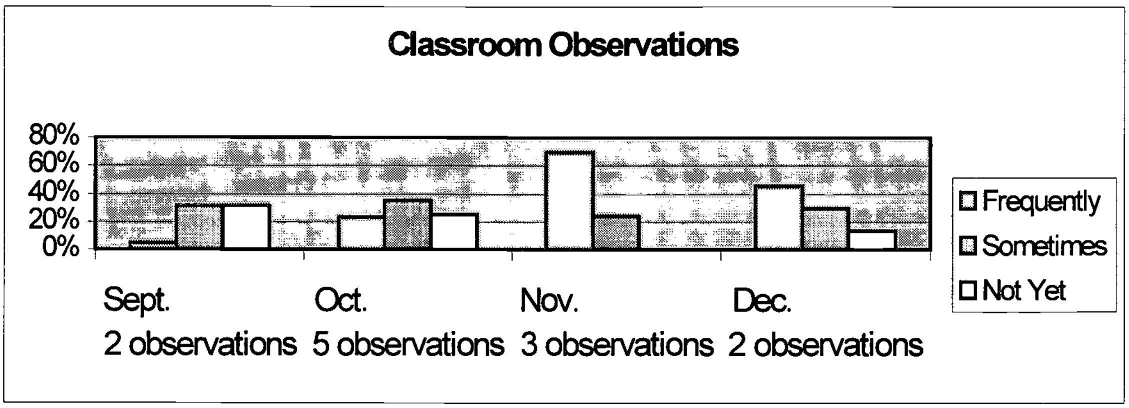


Figure 4. Classroom observations completed September 1998 through December 1998.

When comparing student behavior with the teaching of technical skills and learning skills, it was noticed in the 12 classroom observations that there is a positive correlation between student behavior and the teaching of technology skills. This relationship might suggest that the teaching of technology skills resulted in more desirable student behaviors. This association appeared to be consistent with the relationship between learning skills and student behavior variables. This correlation was also supported through staff interview documentation. For example, a staff member reported "Since the increase in technology integration into my curriculum, discipline problems have almost been nonexistent."

The observation categories represented by the (X) axis were arranged from observations having lowest correlational relationship between variables to observations having highest correlational relationship between variables. The data presented in Figure 5 represents the *frequently* (See Appendix D) responses only.

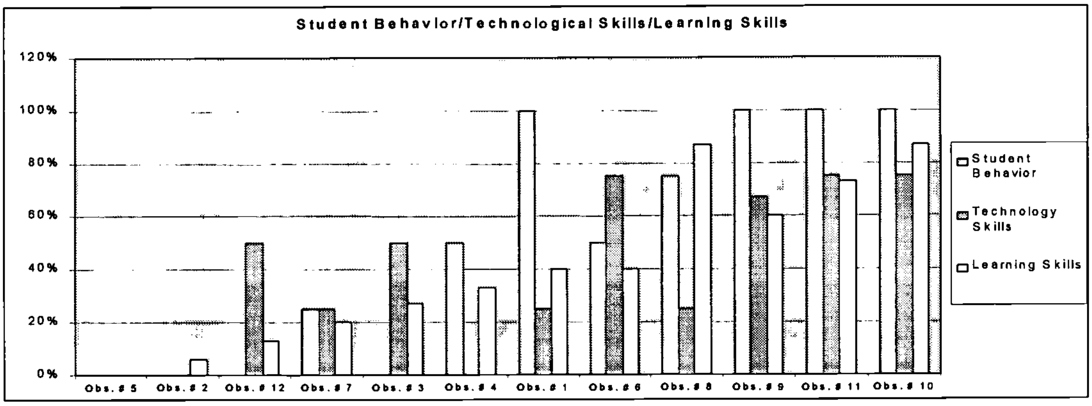
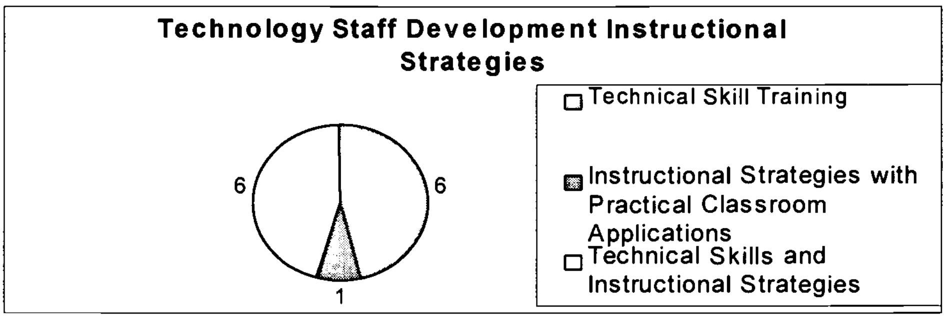


Figure 5. Classroom observations of student behavior/technology skills/learning skills.

In chapter two concerning technology staff development issues, it was reported that teachers felt technology staff instruction was mainly technical skill training and this instruction was not providing practical applications. Ten of fourteen (71%) teachers responding felt that technology staff development was mainly comprised of technical training with little emphasis on practical classroom applications and instructional pedagogy. Only three teachers felt that the district technology staff development provided practical classroom applications, and only one teacher felt that staff development included both practical applications and instructional strategies.

Final staff surveys in January showed that the number of staff feeling district technology staff development is mostly technical skills training had decreased from ten of fourteen (71%) to six of thirteen (46%). Eighteen staff members completed the initial survey conducted the first week of school, and 17 staff members completed the final survey in January 1999. The decrease in the percentage of staff who felt that technology staff development is more than just technical training was seen as a desired outcome. In comparison, the number of staff viewing technology staff development training as a mixture of both technical skills and instructional strategies increased from three (21%) to six (46%). This data is also seen as progress directly related to the research project. Comparative baseline and final data related to technology staff development instructional strategies are given in Figure 6.



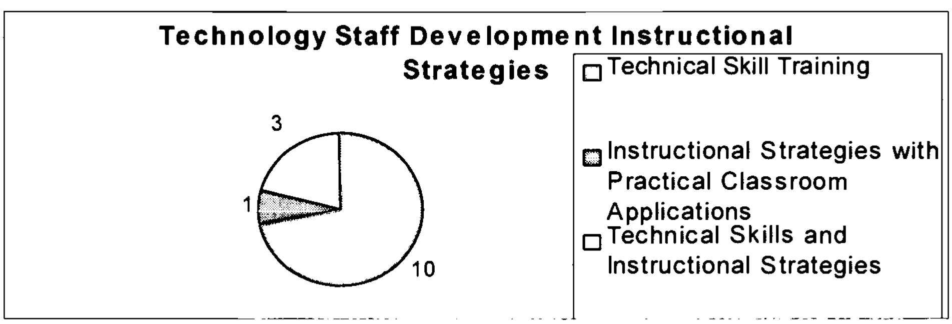


Figure 6. Staff development instructional strategies (baseline data/final data)

Final staff surveys also indicated that teachers were using the Internet more to enhance teaching and learning opportunities for students. Initially, seven out of eighteen staff (39%) reported that the Internet was not (none) enhancing teaching and learning opportunities for students; whereas, final surveys indicated that only three out of seventeen (18%) felt that the Internet was not (none) enhancing teaching and learning opportunities for students (See Figure 7). Several extraneous variables may have contributed to this attitude toward the Internet enhancing student learning opportunities. First, during this research project the district was conducting an employee computer purchase program that put 22 new Internet ready computers in the homes of district staff members (31%). Second, an additional two and half computer labs were set up for student access in the high school building. Third, within the high school, an additional eight computers were installed in individual classrooms.

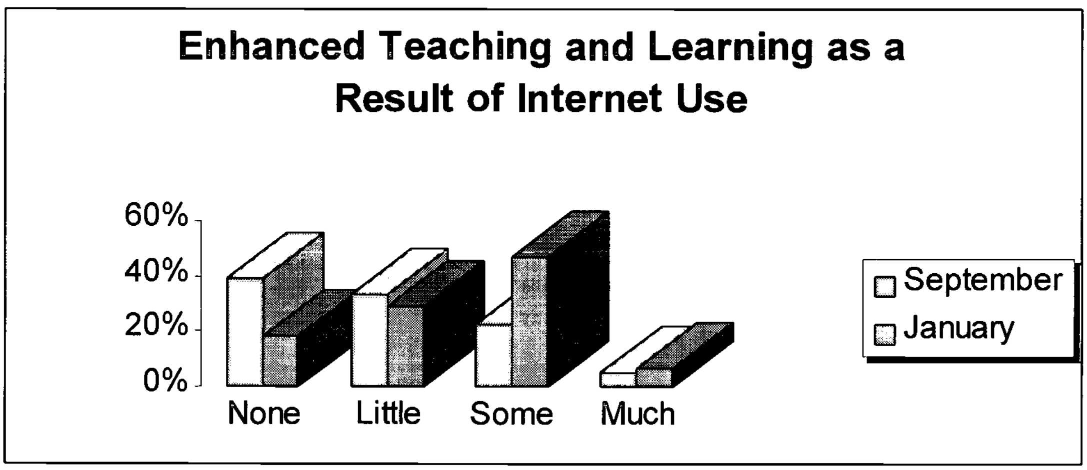


Figure 7. Enhanced teaching and learning as a result of Internet use (baseline data versus final data).

Conclusions and Recommendations

Based on the presentation and the analysis of the data, improvements were made regarding technology staff development instructional strategies. Based on document analysis and classroom observations, the information presented through technology staff development, teacher interviews and specific classroom interventions have made a positive impact in the correct use of technology at the targeted high school.

When students and teachers are prepared to use the technology, students have input (constructivist learning) into the their learning and tasks represent meaningful activities. Then, students are not frustrated, and tend to cooperate and function at a higher excitement level. The improvements in technology and learning instruction can be correlated directly to student behavior, cooperation, and excitement. It was not the intent of the researcher to define a causal relationship between the correct use of technology and student behavior. It also, was not the intent of the researcher to show a causal relationship between the correct use of technology skills/learning skills and student achievement. Instead, the intent was to describe how technology/learning and instructional practice impact student behaviors, such as excitement level, motivation, and cooperation. Ultimately, the increases in these student behaviors and improved teacher-technology/learning methodologies may, and probably should, lead to higher student achievement and less technology oversimplification.

After careful consideration, the researcher believes several recommendations should be addressed. First, to present technology staff development on three levels: Level 1 using technology for presentation in the classroom; Level 2, for technology classroom instruction where students used technology for simulations and applications; Level 3, technology instruction that used higher level thinking skills and or constructivist pedagogy. Second, set requirements for staff needs and development. Recommend level 1 for those staff members who need technology to enhance the presentation of content material. Recommend level 2 for staff who use technology on a daily basis, use technology as an integral part of the course-work, or are in a field of study where technology is necessary for future student employment. Recommend level 3 instruction to enhance learning in every subject area as an essential element in the design of technological lessons. Third, technology staff development also needs to integrate technology skills with learning skills. These skills need to be presented by practical and authentic methods that are easily transferred to the classroom. This need for technology staff development to provide practical and authentic types of lessons is a critical element in the overall transfer of learning to the classroom.

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Appendix A
Teacher Survey

Technology for Learning Teacher Survey

I. Background information

1. Which of the following best describes **your teaching assignment**?

   A. Academic
   B. Vocational
   C. Other

2. Number of years teaching experience _____Years

3. How many **Technology staff development classes** have you taken in the last three years?
   A. 0
   B. 1-2
   C. 3-5
   D. 5+

4. What **level of computer expertise** do you consider yourself to be at?

   A. Novice
   B. Intermediate
   C. Advanced
   D. Expert

5. Do you currently have access to the Internet at home?

   1. Yes
   2. No

II. Teaching and Learning

6. What is the **level of student interest, involvement, and commitment** to using technology to enhance teaching and learning in your teaching assignment?

   A. Few students
   B. Some students
   C. Most students

Appendix A
Teacher Survey

7. What is the level of staff **interest, involvement, and commitment** to using technology to enhance teaching and learning in your building?

   A. Few Staff
   B. Some Staff
   C. Most Staff

8. To what extent is **software linked to your curriculum?**

   A. None
   B. Little
   C. Some
   D. Much

9. What **percentage of your instructional class time** is spent using technology for writing, collecting, analyzing data and gathering information (i. e. word processing, database, spreadsheet etc.)?

   A. Less than 20%
   B. 30-50%
   C. More than 50%

10. Technology is integral to **teaching and learning**.

    1. Strongly agree
    2. Agree
    3. Disagree
    4. Strongly disagree

11. Approximately **how many lesson plans** in the last six months have included an Internet component (student work/research using the Internet)? ______# of Plans

12. What percentage of your **lesson planning time** is spent using the Internet for instructional planning? _____ Percent

13. To what degree has the use of the Internet **enhanced your teaching and learning opportunities** for students?

    A. None
    B. Little
    C. Some
    D. Much

14. I have used computer technology to provide learning experiences for students that would **otherwise be unavailable** (i. e. simulated lab experiments, virtual field trips, problem solving situations, simulations that stimulate higher level thinking skills).

    1. None
    2. Little
    3. Some
    4. Much

15. The use of computer technology in the classroom has allowed me to increase attention to **individual student learning**.

    1. None
    2. Little
    3. Some
    4. Much

16. How important is the **access to global electronic communications** systems such as the Internet to the educational process?

    1. None
    2. Little
    3. Some
    4. Much

17. How important is the infusion of technology into the learning process for **all students**?

    1. Not important at all
    2. Not too important
    3. Somewhat important
    4. Very important

18. How important is the infusion of technology into the learning process for **low-income students**?

    1. Not important at all
    2. Not too important
    3. Somewhat important
    4. Very important

19. How important is the infusion of technology into the learning process for low **achieving students**?

    1. Not important at all
    2. Not too important
    3. Somewhat important
    4. Very important

20. What is the level of **community/parent** interest, involvement, and commitment to using technology to enhance teaching and learning.

    1. Few community/parent
    2. Some community/parent
    3. Most community/parent

21. To what degree do you feel that you could **provide data to support** that learning and teaching are improved with the use of technology?

    1. None
    2. Little
    3. Some
    4. Much

22. To what degree do you feel teachers in the High School, use and integrate **multiple forms of technology** (research, author, publish etc.) into their instructional practices?

    1. None
    2. Little
    3. Some
    4. Much

23. How **many** high school teachers do you perceive as using technology in their instructional strategies? ______ Teachers

24. To what degree do you feel that technology can **improve** feedback on learning in order to improve it and help **make instructional decisions**.

    1. None
    2. Little
    3. Some
    4. Much

III. Student Achievement

25. Our District has invested in computer technology to **improve student achievement**.

    1. Strongly Agree
    2. Agree
    3. Disagree
    4. Strongly disagree

26. Do you perceive that the use of computer technology has improved grades for **all students**?

    1. Strongly Agree
    2. Agree
    3. Disagree
    4. Strongly disagree

27. Do you perceive that the use of computer technology has improved grades for **low-income students**?

    1. Strongly Agree
    2. Agree
    3. Disagree
    4. Strongly disagree

28. Do you perceive that the use of computer technology has improved grades for low **achieving students**?

    1. Strongly agree
    2. Agree
    3. Disagree
    4. Strongly disagree

29. Do you perceive that the use of computer technology has contributed to **improved IGAP scores**?

    1. Strongly agree
    2. Agree
    3. Disagree
    4. Strongly agree

30. Do you perceive that the use of technology has contributed to student acquisition of skills valuable **<u>in the workplace</u>**?

    1. Strongly agree
    2. Agree
    3. Disagree
    4. Strongly disagree

IV. Training

31. Which of the following best describes the technology training that you have taken **<u>provided by the District.</u>**

    1. Mostly technical skills training (How to).
    2. Mostly instructional strategies with practical applications for the classroom.
    3. A mixture of both technical skills and instructional strategies training.
    4. I have not participated in the technology staff development program.

32. Do you feel that the present training program provides you with the necessary tools to effectively use the **<u>hardware and software provided by the district</u>**.

    1. None
    2. Little
    3. Some
    4. Much

33. To what degree has the technology staff development training **<u>improved the integration of technology in your classroom?</u>**

    1. None
    2. Little
    3. Some
    4. Much

Appendix B

Technology for Learning
Teacher Interview

1. What does technology oversimplifications mean to you?

2. Can you give specific examples of technology oversimplification?

   What do you perceive as the underlying causes for the existence of technology oversimplification in your cited examples?

3. In what ways do you use technology in your teaching?

4. Do you encourage students to use technology to communicate with people beyond school for classroom activities?

5. What type of technology training best suits your needs?

   Individual mentoring
   Small Group training
   Group training during the school day that is inside the building
   Outside the building

6. How would you use a technology coach? What is a technology Coach?

7. To what extent does technology motivate students?

Appendix C

Technology for Learning Document Analysis

Technology Project rubrics

Skills/Behaviors	Level	None	Fair	Good	Excellent
Student Behaviors					
Student frustration level					
Student excitement level					
Student cooperation level					
Student motivation level					
Other					
Technological Skills					
Involves authentic assessments					
Involves performance assessments					
Individual student computer literacy skills (examples, saving spell check, printing)					
Image processing					
Other					
Learning Skills					
Involves new instructional and assessment roles for students					
Requires students to produce or create something					
Address the students multiple intelligences					
Involves new instructional strategies for teacher					
Peer review					
Allows for students to ask questions					
Cooperative learning environment					
Allows for students to have input into learning process (constructivist)					
Involves real-world applications (relevance)					
Uses tasks that represent meaningful instructional activities					
Uses students as teachers					
Foster the learner's ability for higher-order thinking and problem solving skills					
Integrates learning					
Accommodates different learning styles					
Hyper-homework					
Allows for student collaboration					
Other					

Appendix D
Technology for Learning Classroom Observations

Skills/Behaviors	*Tech. Level*	*Frequently*	*Sometimes*	*Not yet*
Student Behaviors				
Student frustration level				
Student excitement level				
Student cooperation level				
Student motivation level				
Other				
Technological Skills				
Involves authentic assessments				
Involves performance assessments				
Individual student computer literacy skills (examples, saving spell check, printing)				
Image Processing				
Other				
Learning Skills				
Involves new instructional and assessment roles for students				
Requires students to produce or create something				
Address the students multiple intelligences				
Involves new instructional strategies for teacher				
Peer review collaboration among students				
Allows for students to ask questions				
Cooperative learning environment				
Allows for students to have input into learning process (constructivist)				
Involves real-world applications (relevance)				
Uses tasks that represent meaningful instructional activities				
Students as teachers				
Foster the learner's ability for higher-order thinking and problem solving skills				
Allows for student collaboration				
Accommodates different learning styles				
Integrates learning				
Other				

Appendix E
Technology Staff Development Class

District Computer Technology Staff Development

Class: The Destination (Uses and Troubleshooting) ***(Level 1-Presentation Level)***

Date: Thursday, September 4, 1998

Time: 3:30-4:30 p.m.

Instructor: ******* *****

Place: HS Technology Lab

Technology in your classroom Series

The program will focus on how to use the destination in your classroom. It will include demonstrations of CD-ROM's, Power Point, note giving, lesson planing using a presentation package, and Internet site usage. After the demonstrations, a scenario of possible problems will be discussed and simple solutions will be given. Discussions on different technology presentation techniques will also be conducted.

****

______ Yes, I want to be a part of the technology program-The Destination Presentation Class.

Name: __________________

Grade Level: __________________

Subject Area: __________________

Appendix F
Technology Staff Development Class

District Computer Technology Staff Development

Class: Designing lessons with a taste of technology ***(Levels 2 & 3 Simulations, applications, and higher level thinking skills)***

Date: Tuesday, September 15, 1998

Time: 3:30-5:30 p.m.

Instructor: ********* ******

Place: HS Technology Lab

Technology in your classroom Series

For this program each participant should bring a lesson plan with him or her. The group will help brainstorm ideas for technological elements that might be used to enhance the lesson. Will also take a look at how the lesson might address higher level thinking skills. The instructor will find a list of web sites matching your lesson plan and download to disk for your use in the classroom. **Please send a copy of your lesson plan with your sign up sheet.**

****

_____ Yes, I want to be a part of the technology program-lessons with a taste of technology

Name: ____________________

Grade Level: ____________________

Subject Area: ____________________

Appendix G
Technology Staff Development Class

District Computer Technology Staff Development

Class: Using the Internet to extend the classroom ***(Level 3 Higher level thinking and constructivist lesson planning)***

Date: Thursday, October 98 1998

Time: 3:30-5:30 p.m.

Instructor: **** *******

Place: HS Technology Lab

Technology in your classroom Series

The program will focus on how to use the Internet for enhancing lesson plans to include constructivist ideas and higher level thinking skills. The Global School Net project will be discussed and the following URL's will be presented.

1. www.nctp.com
2. www.nsba.org
3. www.stclair.k12.us/makethelink/mlgrid.htm
4. www.ncrel.org
5. www.educationworld.com

****

______ Yes, I want to be a part of the technology program-Using the Internet to extend the classroom

Name: ___________________

Grade Level: ___________________

Subject Area: ___________________

Appendix H
Technology Staff Development Class

District Computer Technology Staff Development

Class: Technology Coaches and Hyper-homework **(Levels 1-3)**

Date: Thursday, October 22, 1998

Time: 3:30-4:30 p.m.

Instructor: **** *******

Place: HS Technology Lab

Technology in your classroom Series

The program will focus on using High School students and technology experts as coaches in your classroom. We will also introduce the idea of hyper-homework, technology exercises that goes beyond busy work.

****

______ Yes, I want to be a part of the technology program- Technology Coaches and Hyper-homework

Name: ________________

Grade Level: ________________

Subject Area: ________________

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